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Field efficacy evaluation and standardization of dose of a novel molecule, etoxazole 10% SC (w/w) against the red spider mite, *Tetranychus cinnabarinus* infesting brinjal (*Solanum melongena*)

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ABSTRACT

A field experiment was conducted at the Central Research Station farm of Orissa University of Agriculture & Technology, Bhubaneswar, Odisha, India during summer seasons of 2010 and 2011 to evaluate the field efficacy and find out the correct dose of a novel molecule etoxazole 10% SC (w/w) for management of the red spider mite, *Tetranychus cinnabarinus* (Boisd.) infesting brinjal (*Solanum melongena* L.). The chemical etoxazole was evaluated @ 10, 25, 40 and 55 g a.i./ha along with fenpropathrin, hexythiazox and propargite @ 100, 25 and 570 g a.i./ha, respectively. The results revealed that at 21 days after spraying (DAS), the chemical treatments, etoxazole 10% SC (w/w) @ 40 and 55 g a.i./ha and hexythiazox 5.45 EC emerged significantly the best with a record of 0.91-1.14 mites/ 4cm^2 leaf area and registering 78.03-82.47% reduction over untreated control (5.19 mites/4cm^2 leaf area). Other chemical treatments did not offer satisfactory control of the mites at 21 DAS. Significantly highest marketable fruit yield was recorded in the higher doses of etoxazole 10% SC (w/w) treatments, i.e. @ 40 and 55 g a.i./ha (21.01-21.17 tonnes/ha) with 24.84-25.79 per cent increase in fruit yield over untreated control (16.83 tonnes/ha) closely followed by hexythiazox (20.92 tonnes/ha).

Key words: Management, Novel molecule, Red spider mite, *Solanum melongena, Tetranychus cinnabarinus*

Brinjal (*Solanum melongena* L.) is an important tropical vegetable crop cultivated throughout the year in all parts of India and many other countries. Among the different arthropod pests attacking brinjal, the red vegetable mite, *Tetranychus cinnabarinus* (Boisd.) is the main threat next to shoot and fruit borer during summer season. As a result of infestation, plant growth, flowering and fruit setting are seriously affected. There are reports of 32-100 per cent yield loss due to attack of *Tetranychus* spp. in brinjal crop during summer months (Patil and Nandihalli 2009). Farmers mostly depend on synthetic acaricides for managing mite pests because of instant knockdown effects often leading to problems like pesticide resistance (Jeyarani *et al*. 2010), pest resurgence, environmental pollution and destruction of natural enemies of the pest etc. (Vinothkumar *et al*. 2009). With the aim of finding out an alternative chemical with novel mode of action with satisfactory control of the target pest, the present field investigation was undertaken.

MATERIALS AND METHODS

The field study was conducted in the Central Research Station farm of Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India during two consecutive summer seasons of 2010 and 2011. The experiment was designed in a randomized complete block design with eight treatments replicated three times. Brinjal variety Utkal Anushree was grown in plots measuring 4.5m×4.5m each with spacing of 90cm×90cm using a fertilizer dose of 125:75:125 kg N:P_2O_5:K_2O/ha. All other agronomic practices were followed for raising the crop as per the recommendation for the State except plant protection. The insecticide treatments were: T_1, T_2, T_3 and T_4, = etoxazole 10% SC @ 10, 25, 40, and 55 g a.i./ha, respectively, T_5 = fenpropathrin 30 EC @ 100 g a.i./ha, T_6 = hexythiazox 5.45EC @ 25 g a.i./ha, T_7 = propargite 57EC @ 570 g a.i./ha and T_8 = Untreated control. Chemical treatments were applied on appearance of the mites on the crop through foliar spraying with high volume knapsack sprayer fitted with hollow cone nozzle using 500 litres of spray fluid per hectare. Altogether three applications were made at 4 weeks interval.

Observations were recorded on the population of red spider mite, *Tetranychus cinnabarinus* (Boisd.) per four square centimeter (2cm×2cm leaf bit) from each of three matured tender leaves selected from apical portion at three different places of five randomly selected plants from each plot at one day before each spraying (DBS) and at 03, 07,

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Table 2 Marketable fruit yield of brinjal (cv Utkal Anushre) at Bhubaneswar

	Treatment	Dose (g a.i./ha)	Marketable fruit yield of brinjal (tonnes/ha)					
			Summer, 2010	% increase in yield over control	Summer, 2011	% increase in yield over control	Pooled fruit yield	% increase in yield over control
T_1	Etoxazole 10% SC (w/w)	10	18.70d	14.02	19.56d	13.26	19.13d	13.67
T_2	Etoxazole 10% SC (w/w)	25	19.83c	20.91	20.42c	18.24	20.12c	19.55
T_3	Etoxazole 10% SC (w/w)	40	20.58a	25.49	21.45a	24.20	21.01a	24.84
T_4	Etoxazole 10% SC (w/w)	55	20.72a	26.34	21.63a	25.25	21.17a	25.79
T_5	Fenpropathrin 30%EC	100	19.76c	20.49	20.54c	18.93	20.15c	19.73
T_6	Hexythiazox 5.45%EC	25	20.47b	24.82	21.37b	23.74	20.92b	24.30
T_7	Propargite 57%EC	570	19.72c	20.24	20.40c	18.12	20.06c	19.19
T_8	Untreated control (UTC)		16.40e		17.27e		16.83c	
	SE (m)±		0.08		0.08		0.08	
	CD (P = 0.05)		0.24		0.23		0.24	
	CV (%)		6.84		5.96		6.40	

Means followed by a common letter in a column are not significantly different from each other

Table 1 Population of red spider mite, *Tetranychus cinnabarinus* in different chemical treatments at Bhubaneswar (Pooled Summer, 2010 and Summer, 2011)

Treatment	Dose (g a.i/ha)	No. of red spider mites per 2cm×2cm leaf bit in brinjal						
		1 DBS	3 DAS	7 DAS	10 DAS	14 DAS	21 DAS	% reduction over control
T_1 Etoxazole 10% SC (w/w)	10	5.14 (2.37)	2.48 (1.72)c	2.66 (1.77)c	2.71 (1.79)c	3.52 (1.98)c	5.05 (2.36)b	2.70
T_2 Etoxazole 10% SC (w/w)	25	4.99 (2.34)	1.28 (1.33)b	1.40 (1.38)b	1.50 (1.41)b	2.12 (1.62)b	4.81 (2.30)b	7.32
T_3 Etoxazole 10% SC (w/w)	40	5.02 (2.35)	0.10 (0.77)a	0.14 (0.80)a	0.19 (0.83)a	0.60 (1.04)a	1.00 (1.22)a	80.73
T_4 Etoxazole 10% SC (w/w)	55	4.88 (2.32)	0.00 (0.71)a	0.05 (0.75)a	0.09 (0.77)a	0.50 (1.00)a	0.91 (1.19)a	82.47
T_5 Fenpropathrin 30%EC	100	5.02 (2.35)	1.24 (1.32)b	1.36 (1.36)b	1.45 (1.40)b	2.07 (1.60)b	4.87 (2.31)c	6.16
T_6 Hexythiazox 5.45%EC	25	4.97 (2.34)	0.12 (0.79)a	0.17 (0.82)a	0.25 (0.87)a	0.60 (1.04)a	1.14 (1.28)a	78.03
T_7 Propargite 57%EC	570	4.94 (2.33)	1.16 (1.29)b	1.29 (1.34)b	1.43 (1.39)b	2.21 (1.64)b	4.78 (2.30)b	7.89
T_8 Untreated control (UTC)		4.98 (2.34)	5.02 (2.35)d	5.07 (2.36)d	5.12 (2.37)d	5.16 (2.38)d	5.19 (2.38)b	
SE (m)±		(0.05)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	
CD (P = 0.05)		(NS)	(0.10)	(0.08)	(0.11)	(0.09)	(0.09)	
CV (%)		5.02	7.28	6.74	8.52	6.22	4.84	

DBS = Day before spraying, DAS = Days after spraying. Figures in the parentheses are X+0.5 square root transformed values. Means followed by a common letter in a column are not significantly different from each other

10, 14 and 21 days after each spraying (DAS). The leaf samples were collected and observed under stereo binocular microscope in the laboratory for different stages (nymphs and adults) of phytophagous mites. Treatment-wise marketable fruit yield was recorded at each economic harvest. The data were subjected to transformation wherever necessary before statistical analysis following Gomez and Gomez (1984) and subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The pooled mean data (Table 1) on population of red spider mite, *T. cinnabarinus* did not vary at one day before spraying (DBS) (4.88-5.14/4cm^2 leaf area) indicating uniform distribution of the pest throughout the experimental plot. All the chemicals evaluated in the field proved their

superiority in significantly suppressing the mite population compared to untreated control up to 14 DAS. At 21 DAS, among the chemicals tested, etoxazole 10%SC (w/w) @ 40 and 55 g a.i./ha and hexythiazox 5.45EC @ 25 g a.i./ha registered significantly less number of mites (0.91-1.14) / 4cm^2 leaf area. Other treatments did not offer satisfactory control of mites (4.78-5.05 mites/4cm^2 leaf area) at 21 DAS and the efficacy remained at par with the untreated control (5.19 mites/4cm^2 leaf area). Ashley *et al*. (2006) observed 100% mortality of eggs and significant mortality of a mixed stage population of *T.urticae* with etoxazole treatment. Celoto and Geraldo (2010) reported ovicidal effect, mortalities in the young forms and sterilizing effect of etoxazole on females of Citrus Leprosis mite, *Brevipalpus phoenicis* (Geijskes) at different doses. Cloyd *et al*. (2009) recorded more than 85% mortality of two-spotted spider mite, *Tetranychus urticae* Koch under greenhouse conditions with etoxazole. Chakraborty *et al.* (2010) obtained cent percent mortality of red spider mite of tea, *Oligonychus coffeae* Neitner using etoxazole @ 22-33 g a.i./ha. The reduction in the number of red spider mite in the treatments receiving higher doses of etoxazole (40 and 50g a.i./ha) in brinjal may be attributed to the ovicidal and mortality effect on different stages of the mite in the present study as reported by the above workers. The insecticidal and acaricidal action of etoxazole through strong chitin biosynthesis inhibition might be another reason of reduction in the mite population (Nauen and Smagghe 2006). Thus, acaricidal action of etoxazole in the present study is consonant with the findings of above workers.

The marketable fruit yield of brinjal (cv Utkal Anushree) recorded significantly higher in all the chemical treated plots (18.70-2072 tonnes/ha) compared to untreated control (16.40 tonnes/ha) during summer 2010 (Table 2). Similar trend of results were also observed during summer, 2011 registering fruit yield of 19.56-21.63 tonnes/ha in chemical treatments compared to untreated control (17.27 tonnes/ha). The pooled mean marketable fruit yield of brinjal followed the same trend as summer, 2010 and summer, 2011 registering significantly highest marketable fruit yield in the treatments etoxazole 10% SC (w/w) @ 40 and 55 g a.i./ha (21.01-21.17 tonnes/ha) with 24.84-25.79 per cent increase in yield over untreated control (16.83 tonnes/ha) followed by hexythiazox 5.45 EC @ 25g a.i./ha (20.92 tonnes/ha) with 24.30 per cent increase in yield over untreated control. In all other chemical treatments the fruit yield ranged from 19.13-20.15 registering 13.67-19.73 per cent increase in yield over untreated control. Significantly highest fruit yield of brinjal with etoxazole 10% SC (w/w) @ 40 and 55 g a.i./ha may be attributed due to both insecticidal and acaricidal action of the chemical compared to only acaricidal effect of hexythiazox.

It may be concluded from the present study that the efficacy of both etoxazole 10% SC (w/w) @ 40 g a.i./ha and 55 g a.i./ha were statistically similar to hexythiazox 5.45 EC @ 25g a.i./ha in suppressing brinjal red spider mite population. But, etoxazole 10% SC (w/w) @ 40 g a.i./ha appeared to be the promising candidate for use in the mite management programme and may be recommended as an alternative to hexythiazox and other conventional acaricides.

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